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(54) VENTILATION VALVE FOR ROTATABLE HOLLOW BODY

(71) We, UNI-CARDAN AKTIENGESELLSCHAFT, a Company organised and existing under the laws of the Federal German Republic, of 5204 Lohmar/Rheinl 1, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a ventilation valve, for the internal cavity of a rotatable hollow body which is filled partly with a liquid and partly with a gas. The invention is particularly applicable to the ventilation of a universal joint which is sealed by a flexible boot or the like, or of relatively telescopically slidable shaft members, in which the liquid is a lubricant such as a grease or lubricant of which the viscosity may change under operational conditions.

Certain conventional valves for the lubricating and ventilation of machine parts subject to frictional wear include the provision of a duct or channel which remains permanently open after the lubricating function has been performed in order to take care of ventilation, or "breathing".

However, a permanently open ventilation or breather valve of this kind can be used only where the disposition of the valve is such that the lubricant cannot escape when the parts are stationary, for example by reason of the fact that the valve opening is situated above the upper level of the lubricant within the part, or that the viscosity of the lubricant itself prevents its escape.

It is the aim of this invention to provide a valve which is suitable for ventilating rotating, hollow bodies filled with liquids of relatively thinner consistency, and which valve may also be disposed within a zone which is liquid filled when the body is stationary, whilst avoiding loss of liquid after the valve has opened.

According to the present invention, we provide a ventilation valve in association with a rotatable body having an internal cavity, which cavity is filled partially by a liquid and partially by a gas, the valve comprising a valve body including first and second ducts communicating with each other and, respectively, with a central region of said cavity and with external atmosphere, and a movable valve member spring biased into engagement with a valve seat for preventing communication between said first and second ducts and movable away from said valve seat, under centrifugal force upon rotation of said hollow body, to permit such communication, the mass of the valve member and the strength of the biasing spring being such that, in use, said valve member moves away from the valve seat only when the body has sufficient speed of rotation to ensure that the boundary surface between the liquid and the gas lies radially outwardly of said central region, into which said first duct opens, the valve member being mounted for displacement in a direction transverse to the axis of rotation of the hollow body, with the valve seat and first duct afforded by a part of the valve body situated on one side of said axis and the major mass of the valve member contained in a further part of the valve body situated on the opposite side of said axis.

The advantage of this arrangement resides in that the valve remains closed while the body is stationary so that the opening of the first duct may be arranged within a region which the internal liquid occupies when stationary. The valve will open only when a predetermined speed of revolution has been reached which is required to spin the liquid in such a way as to create a centrifugal wall of liquid within the hollow body.

A ventilation valve of this kind may be applied with special advantage where high speeds of revolution are involved accompanied by the additional dangers of excessive pressure and inflation of elastic sealing boots or the like, which conditions naturally entail a high degree of wear and a risk of such sealing boots being destroyed.

A ventilation valve of this kind is particularly desirable in transmission joints for

motor vehicles, of the kind which are encased by a flexible sealing boot or concertina bellows, in order to prevent inflation of the boot or bellows and damage to the latter caused by excessive pressure due to volume variations arising from the relative sliding and bending displacements of the joint members as well as from the heating up of gases contained, and/or formed in the interior of the joint.

The valve body may have an additional duct communicating with the first duct, extending radially outwardly from the axis of rotation of the hollow body and communicating with the internal cavity thereof. This prevents any particles of the liquid being carried, or swept along with the air (gas) entering, or leaving the internal cavity by way of the first duct as a result of volume variations.

For achieving rapid draining or exhaustion of the first duct, it may be arranged so as to extend and open out in a direction radially or obliquely away from the axis of rotation of the hollow body.

There may be provided a further duct communicating with the first duct and opening into a region closer to the axis of rotation of the hollow body than does the first duct.

The valve may be mounted in the interior cavity, or in the outside, of the hollow body. The design of the valve and its disposition should be such as largely to avoid the risk of imbalance, particularly at high speeds of revolution.

Two preferred embodiments are diagrammatically illustrated by way of example in the accompanying drawings wherein:

Figure 1 shows a constant velocity universal joint fitted with a valve according to this invention.

Figure 2 illustrates the disposition of a valve in the interior cavity of the joint.

Figure 3 shows a valve fitted externally of the interior cavity of the joint.

Figures 1 and 2 illustrate the provision of a ventilation of breather valve 1 in the internal cavity 8 of a constant velocity universal joint. The valve 1 is secured on the inside of a rear wall 2 of the outer joint member 3, the valve being oriented transversely of the axis of rotation 15 of the joint. The valve includes a housing or valve body 17, with a tubular connection portion 14, which contains a bore 11 and extends outwardly through the rear wall 2. The portion 14 has a male screw thread adapted to be engaged by a hexagonal nut 4 for securing the valve body 17 in place.

The valve 1 comprises the valve body 17 within which is disposed a slidable valve member 5. The valve member 5, which is slidable transversely of the axis of rotation of the joint, is biased by a spring 6 towards a valve seat 7, and when in contact with the valve seat 7 prevents communication between a bore 9 which constitutes a first duct part communicating within the interior of the joint and the bore 11 which constitutes a second duct part communicating with the atmosphere.

The part of the valve body 17 which contains the valve member 5 and spring 6 is disposed on the opposite side of the axis of rotation 15 of the joint to the part of the valve body which is provided with bore 9. The arrangement of the valve member 5 is such that centrifugal force, when the joint is rotating, tends to move the valve member away from the valve seat 7, such movement actually taking place when the centrifugal force acting on the valve member 5 exceeds the force of the spring 6 tending to hold the valve member on its seat. When such movement takes place, the bore 9 is in communication with the bore 11 by way of the interior 10 of the valve, and ventilation of the internal cavity of the joint can then take place.

The strength of the spring 6 and weight of the valve member 5 would be chosen so that opening of the valve occurs only when liquid has been displaced under centrifugal force to a generally annular region which is clear of the opening of the bore 9 within the internal cavity of the joint. The minimum condition for this is that any liquid positioned just outwardly of the entrance to bore 9 should stay in such position, or else tend to move further outwardly from the axis of rotation.

The valve housing 17 may also be provided with a further opening 12 which extends radially outwardly from the axis of rotation of the joint, and thus towards the annular volume of liquid which is built up when the joint is rotating. This provides for the expulsion of any lubricant which may have entered the region of the valve seat 7 as soon as the joint starts to rotate. If the bore 12 should in fact open into the liquid, ventilation of the cavity will still occur by way of bore 9.

The valve 1 shown in Figure 3 is basically the same as that which has been shown in Figure 2 and like reference numerals are applied to similar parts thereof. The valve 1 of Figure 3 is mounted externally of the cavity 8 and a bore 13 constituting the first duct part is provided for exhausting the cavity. This bore 13 extends obliquely relative to the axis of rotation 15 of the outer joint member, that is to say, radially away therefrom. Owing to this disposition of the bore 13, any lubricant contained in the bore will be centrifugally returned into the cavity 8 when the body is rotating.

WHAT WE CLAIM IS:—

1. A ventilation valve in association

with a rotatable body having an internal cavity, which cavity is filled partially by a liquid and partially by a gas, the valve comprising a valve body including first and second ducts communicating with each other and, respectively, with a central region of said cavity and with external atmosphere, and a movable valve member spring biased into engagement with a valve seat for preventing communication between said first and second ducts and movable away from said valve seat, under centrifugal force upon rotation of said hollow body, to permit such communication, the mass of the valve member and the strength of the biasing spring being such that, in use, said valve member moves away from the valve seat only when the body has sufficient speed of rotation to ensure that the boundary surface between the liquid and the gas lies radially outwardly of said central region, into which said first duct opens, the valve member being mounted for displacement in a direction transverse to the axis of rotation of the hollow body, with the valve seat and first duct afforded by a part of the valve body situated on one side of said axis and the major mass of the valve member contained in a further part of the valve body situated on the opposite side of said axis.

2. A valve according to claim 1 wherein the valve body has an additional duct communicating with the first duct, extending radially outwardly from the axis of rotation of the hollow body, and communicating with the internal cavity thereof.

3. A valve according to claim 1 wherein the first duct extends in a direction radially or obliquely away from the axis of rotation of the hollow body.

4. A valve according to claim 3 wherein there is provided a further duct communicating with said first duct and opening into a region closer to the axis of rotation of the hollow body than does the first duct.

5. A valve according to any one of the preceding claims mounted within or externally of the internal cavity of the hollow body.

6. A valve, in association with a rotatable body, substantially as hereinbefore described with reference to and as shown in Figures 1 and 2 of the accompanying drawings.

7. A valve, in association with a rotatable body, substantially as hereinbefore described with reference to and as shown in Figure 3 of the accompanying drawings.

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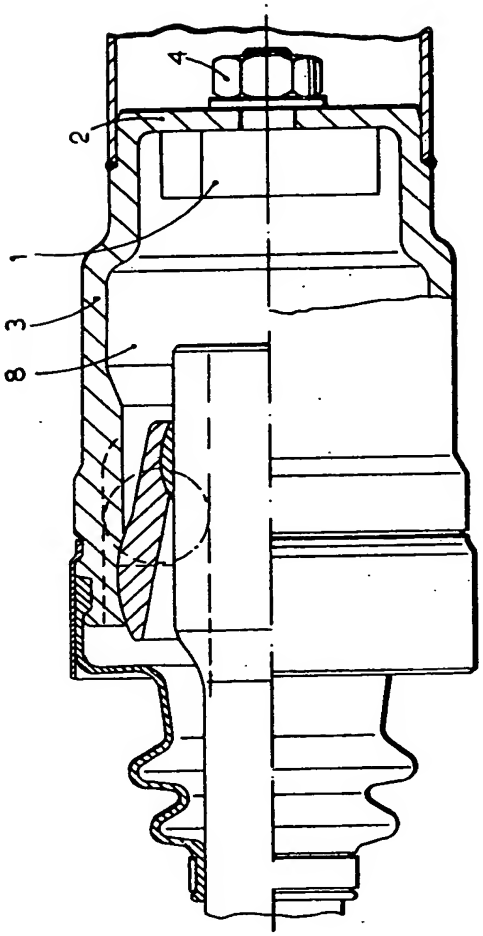

FIG. 1

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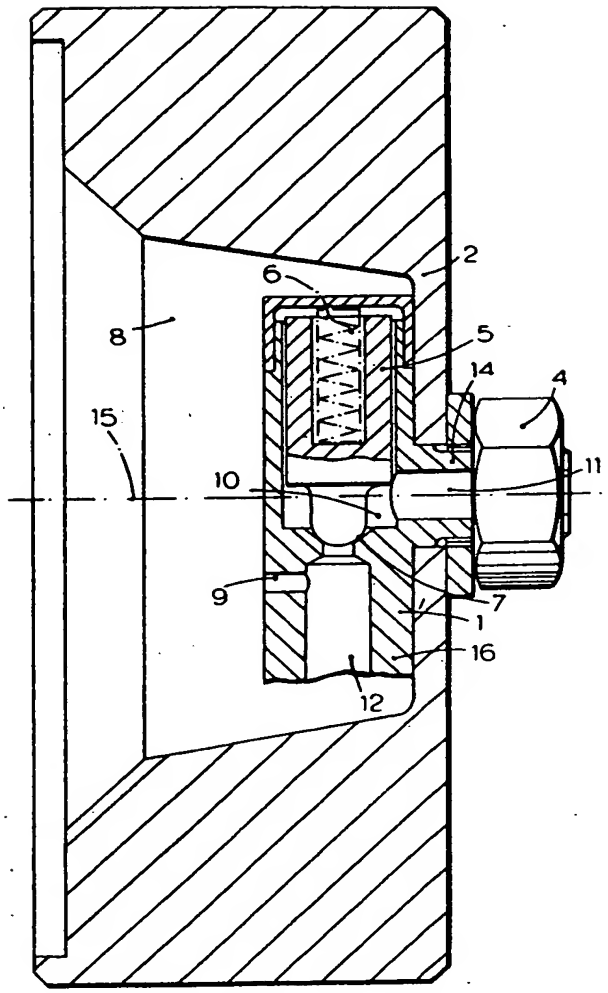

FIG. 2

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Sheet 3

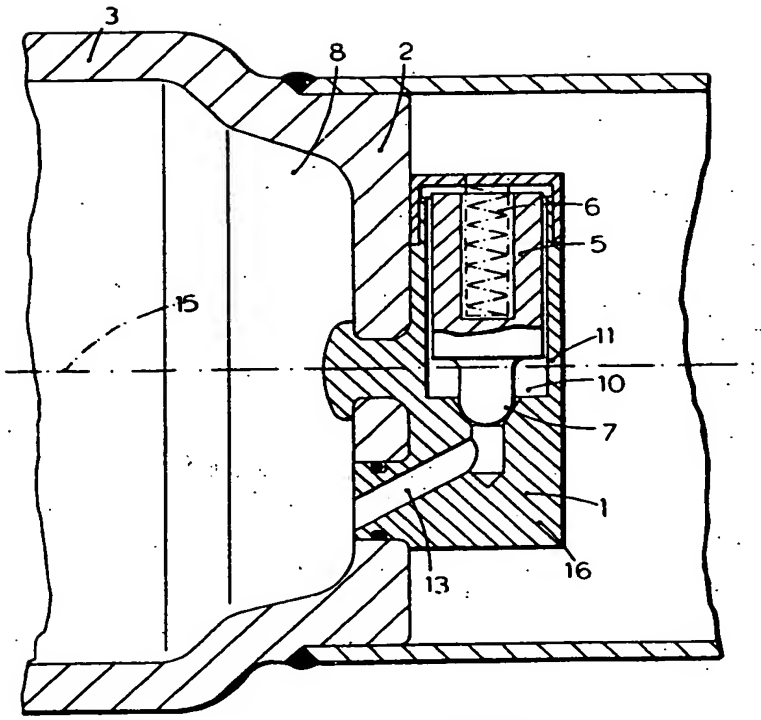

FIG. 3